

What is claimed is:

1. An integrated traffic surveillance apparatus, comprising:  
a digital signal processor structured to receive as inputs thereto a plurality of L-band radio frequency signals containing a plurality of traffic data comprising both Mode Select and  
5 collision avoidance data;  
software resident on the processor comprising executable program code for implementing a plurality of traffic surveillance functionalities comprising both Mode Select and collision avoidance functionalities; and  
wherein the processor is structured for simultaneously operating the software  
10 implementing both the Mode Select and collision avoidance functionalities.
2. The apparatus of claim 1 wherein the digital signal processor further comprises interconnected first and second signal processing circuits structured for simultaneously operating the software for implementing the respective Mode Select and collision avoidance functionalities.
- 15 3. The apparatus of claim 2 wherein the digital signal processor further comprises one or more data busses interconnecting the first and second signal processing circuits.
4. The apparatus of claim 1, further comprising a radio frequency transmitting and receiving module coupled to the processor and structured to transmit and receive different Mode Select and collision avoidance radio frequency signals.
- 20 5. The apparatus of claim 1 wherein the plurality of traffic surveillance functionalities implemented by the software resident on the processor further comprises an airborne surveillance and separation assurance functionality for integrating the plurality of traffic data.
6. The apparatus of claim 1 wherein the plurality of traffic surveillance functionalities further comprises an All Weather Formation Capability (AFC) traffic surveillance  
25 functionality.
7. The apparatus of claim 1 wherein the processor is further structured for simultaneously operating the software implementing all the AFC, Mode Select and collision avoidance functionalities.

8. The apparatus of claim 1, further comprising memory storage means coupled to the processor and accessible to both the Mode Select and collision avoidance functionalities for reading and writing data.

9. An integrated traffic surveillance apparatus, comprising:

5 a radio frequency module comprising a L-band radio frequency transmitter and receiver and being structured to interface with a pair of directional antennas for transmitting and receiving Mode Select and collision avoidance interrogation and reply signals;

a radio frequency synthesizer and intermediate frequency module comprising a plurality of receiver channels for a collision avoidance radio frequency and one or more  
10 dedicated receiver channels for a Mode Select radio frequency, the radio frequency synthesizer and intermediate frequency module being coupled to the radio frequency module for transmitting and receiving Mode Select and collision avoidance interrogation and reply signals; and

a digital module coupled to the radio frequency module to control the interrogation and  
15 reply signals, the digital module comprising a central processing unit structured for simultaneously operating resident executable programming code for common signal processing of different Mode Select and collision avoidance interrogation and reply signals.

10. The apparatus of claim 9 wherein the digital module further comprises different interconnected Mode Select and collision avoidance digital signal processors simultaneously  
20 operating resident executable programming code for common signal processing of respective Mode Select and collision avoidance interrogation and reply signals.

11. The apparatus of claim 10, further comprising a front end module coupled to the radio frequency module and comprising:

an interface structured to couple the radio frequency module to a pair of directional  
25 antennas, and

a switch for periodically coupling the different Mode Select and collision avoidance signal processors to the antenna interface.

12. The apparatus of claim 10 wherein the digital module further comprises a common memory device storing both Mode Select and collision avoidance traffic surveillance data, the

memory being accessible to both the Mode Select and collision avoidance digital signal processors.

13. The apparatus of claim 10 wherein the digital module further comprises one or more internal busses communicating between the Mode Select and collision avoidance digital signal  
5 processors.

14. The apparatus of claim 9 wherein the resident executable programming code further comprises airborne surveillance and separation assurance (ASSA) signal processing code for tracking of position, velocity, and identification data received as radio frequency signals via the radio frequency module.

10 15. The apparatus of claim 9 wherein the resident executable programming code further comprises All Weather Formation Capability (AFC) signal processing code.

16. The apparatus of claim 15, further comprising a digital signal processor coupled to the central processing unit and structured to operate encryption and decryption algorithms.

17. An integrated traffic surveillance apparatus, comprising:  
15 a pair of common directional antennas structured for transmitting and receiving L-band radio frequency signals;  
a common radio frequency transmitter coupled to each of the common antennas for transmitting Mode Select and traffic alert collision avoidance system (TCAS) signals;  
a common radio frequency receiver coupled to the common antennas for receiving  
20 Mode Select and TCAS signals; and  
a digital signal processor coupled to both the transmitter and the receiver, the signal processor having a different Mode Select and TCAS signal processing circuits and being structured for simultaneously processing the Mode Select and TCAS signals.

18. The apparatus of claim 17, further comprising a switch periodically coupling the  
25 common antennas to the different Mode Select and TCAS signal processing circuits.

19. The apparatus of claim 17, further comprising a memory device coupled to both the different Mode Select and TCAS signal processing circuits, the memory device storing data from both the different Mode Select and TCAS signal processing circuits and being structured

such that the stored data is available to both the different Mode Select and TCAS signal processing circuits.

20. The apparatus of claim 17, further comprising one or more internal data busses coupling the different Mode Select and TCAS signal processing circuits.

5 21. The apparatus of claim 17 wherein the digital signal processor further comprises a airborne surveillance and separation assurance (ASSA) signal processing circuit coupled to each of the different Mode Select and TCAS signal processing circuits, the ASSA signal processing circuit being structured for tracking of position, velocity, and identification data received as radio frequency signals via one or both of the antennas.

10 22. The apparatus of claim 21 wherein the ASSA signal processor is further structured for integrating data from the different Mode Select and TCAS signal processing circuits.

23. The apparatus of claim 17 wherein the digital signal processor further comprises a an All Weather Formation Capability (AFC) signal processing circuit coupled to the different Mode Select and TCAS signal processing circuits.

15 24. The apparatus of claim 23, further comprising a crypto-processor coupled to the digital signal processor and structured to operate encryption and decryption algorithms.